National Savings and Economic Growth in Pakistan

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Abstract

The patterns of savings and economic activity in Pakistan appear to deviate considerably with those usually assumed to exist in developing countries. In particular Gross National Savings appears to be largely determined by exogenous factors--it expands prior to the overall increase in GDP. Since a large component of Gross National Savings consists of worker remittances one can assume that many of the Pakistani expatriates accept foreign employment for the purpose of eventually investing.

The main implication of these results is that the country will have a difficult time sustaining investment in manufacturing. With the decline in worker remittances, Gross National Savings rates will gradually come into line with Gross Domestic Savings. At that time the overall pattern of saving and economic activity will revert to the more normal one of Gross Domestic product leading the expansion in savings.

1. Introduction

Modern saving theories indicate that the rate of growth in aggregate real income is an essential determinant of the national saving rate. Rapid growth raises the saving rate. Higher national saving then releases resources for the investment needed to sustain high growth. If investment is discouraged the growth rate falls, as does the saving rate. Hence, one link between saving and investment is the growth rate, which determines saving and is partly determined by investment. For the Asian countries an early study (Fry, 1984) found that a one percentage point increase in the growth rate raises the national saving rate in the 14 sample countries by, on average just over 1 percentage point.

These patterns are well documented for a number of developing countries. It is clear, however, that patterns of financial savings may not always mirror those of physical savings. Here physical savings are defined as the difference between Gross National Savings and financial savings, with financial savings defined as the change in total financial assets (Gupta, 1984, p. 121). For one thing aggregate savings may not be as sensitive to changes in the real interest rate as compared with financial savings because of the possibility of substitution between financial savings and physical assets. Also, the literature suggests that increases in financial savings may be more important for capital formation than simply increases in physical savings (Abbott, 1984). Pakistan's savings patterns have differed in the past in that from those of other Asian countries in that worker remittances have significantly affected their pattern of growth since the late 1970s. In particular these remittances have resulted in gross national savings increasing much more rapidly than gross domestic savings.

The purpose of the analysis below is to assess whether Pakistan's saving patterns have altered the macroeconomic links outline in the first paragraph: despite the increase in worker remittances, have savings generally followed the expansion in GDP? What is the link between savings and private investment? Have increased savings been invested across a wide spectrum of activities or have they been focused areas such as manufacturing? What are the implications for the future?

2. Patterns of Savings

Historically Pakistan has had one of the lower rate of savings in Asia. While many East Asian countries save 25 to 30 percent of their GDP, saving rates in Pakistan, although improving a bit in recent years, have rarely been over 15 percent (Table 1). Public saving has been particularly low, averaging 2-3 percent of GDP.

Khan (1993) notes that the mobilization of domestic resources and their efficient utilization are two of the most crucial tasks in revitalizing the economy of Pakistan. Historically, low saving formation and relatively higher targets of investment and economic growth made it imperative to depend on external resources. Despite heavy domestic borrowing from both private and public sectors, there still has remained an unmet resource gap that has necessitated the dependence on foreign capital.

Traditionally, the government of Pakistan has relied on conventional approaches to increasing domestic saving. First, the government has been encouraging greater saving by the private sector through a package of national saving schemes and by allowing financial institutions to introduce saving incentives. Saving-schemes and saving incentives have not produced satisfying results.

Table 1 shows saving and investment in selected South Asian countries. As noted above saving in Pakistan is very low and, indeed, among the lowest even when compared with neighboring and other developing countries. Explanations of this failure include the low levels of income and high rate of inflation in the country. Moreover, the financial institutions have in general remained inefficient.

The second approach is to increase saving through taxation and incomes policies. In its taxation efforts, the government has not been able to enlarge revenues adequately from private sector incomes. This failure is due to the inelastic character of the tax system and a heavy reliance on indirect taxation, the latter causing the tax system to be inadequate.

Table 1

Savings and Investment Percentages of GDP

Country	Gross Domestic Investment					Gross Domestic Savings				
	60	70	80	90	95	60	70	80	90	95
Pakistan	12	16	18	19	19	5	9	7	12	16
India	17	17	21	23	25	14	16	17	23	22
Sri Lanka	14	19	34	22	25	9	16	11	15	14
Korea	11	25	32	37	37	15	15	25	37	37
Malaysia	14	22	30	34	41	27	27	25	33	36
Singapore	11	39	46	39	33	-3	18	38	45	--

Sources: (IBRD, 1982, 1992a, 1993c, 1997a)

Incomes policies have been only marginally successful. In its wage and price policies, the government adopted impelled methods of savings formation. The working population and the urban consumers have been paying for the savings in the country. The public sector's contributions to domestic saving have remained negligible, mainly due to the inefficiency of state enterprises, rising defense budgets, non-development expenditure and high inflation (Looney 1996). Finally financial reforms have lagged behind those in other parts of the developing world (Looney 1997).

The shortcomings of traditional approaches to both mobilize domestic resources in Pakistan and assess the importance of savings together with a decline in the availability of foreign assistance to that country make it urgent to search for solutions to the problem of resource mobilization outside the scope of conventional strategies and foreign sources (Khan, 1993).

3. New Approaches to Savings and Growth

Gross national savings has also taken on added importance with the development of endogenous growth models. As is well know, the neoclassical growth models (Solow, 1956; Swan, 1956) attribute the rate of long run growth to exogenous factors such as growth rate of labor and exogenous technical change, and say that other factors such as saving rate and accumulation of human capital have no role in explaining the rate of growth. Nor can these models explain one of Kaldor's stylized facts that the growth rates in different countries can differ for an extended period (Targetti, 1997).

The "new" growth theory attempts to explain such differential growth among nations by focusing on saving rate, human capital investment, R&D and so on. Associated with these developments are empirical efforts to explain the rate of growth by various structural factors. Barro (1991) examines the correlation of growth rate with various factors and finds a positive relationship of per capita growth rate with school enrolment variables and a negative relationship with initial income. Using a modified Solow Model to explain the level and growth rate of per capita income Mankiw et al (1992) find that the growth rate is positively related to physical and human capital investment and negatively related to initial income level (conditional convergence). Using a slightly different model Otani and Villanueva (1989, 1990) found that growth in developing countries increased with increased domestic savings ratios, budgetary allocations to improve human capital, and export performance.

Building on the endogenous growth theory, if one assumes (Buiter, 1993) the aggregate co-production function has the property that output is proportional to capital input (in other words there is constant return to scale to capital rather than to

a set of factors, as in the traditional approach) then the rate of growth of the economy, both capital and output, is proportional to the rate of national saving.

4. Savings Mechanisms in Pakistan

The importance of savings to Pakistan's economic future has provided the stimulus for empirical research concerning the determinants of that aggregate. The attempt to encourage saving by raising real interest rates is at the heart of adjustment programs in a number of low- and middle-income developing countries. Higher saving, it is argued, can finance higher investment and lead to faster growth. Worker remittances aside, several studies have attempted to identify the underlying causes of the country's poor savings performance. Of these Khan's (1988) is the most comprehensive. Khan found that (Khan, 1988, p. 709):

1. A significant positive association exists in Pakistan between the real rate of return on deposits and aggregate savings. In particular the interest elasticity of national savings ranges from 0.01 to 0.03, suggesting that given the existing real return on deposits (3.78) if increased by one percentage point then the increase in aggregate (or national) savings will range from 0.3 to 0.8.

2. Aggregate real income (measured or permanent) was also found to be a key determinant of national, financial and physical savings. The marginal propensity to save (MPS) out of real income under various assumptions concerning expectations for three types of saving functions range from 0.06 to 0.21.

3. Financial development measured by the financial intermediation ratio is also found to have a significant and positive ;influence on national and financial. savings while negative influence on physical savings.

4. Besides real income (measured or permanent) and real return on deposits there are other factors such as unanticipated inflation and variability of inflation which are fount to have a significant impact on these savings functions.

Khan feels these findings clearly point out the existence of financial repression on the one hand and lack of financial development on the other in Pakistan. If this is the case the solution would lie in freeing the return on deposits, thus allowing to them to find their equilibrium in a free market environment.

> In particular the authorities should strive to make the real return on deposits positive either by increasing the nominal return or by reducing inflation. Furthermore, a widespread network of financial institutions and a diversified array of financial instruments will increase savings in Pakistan (Khan, 1988, p. 709).

Clearly, Khan has made several strong assumptions concerning causality. In particular he follows the classical assumption that causation runs from increased incomes to increased savings. As noted however, starting in 1976 worker remittances as net factor incomes caused a dramatic shift in the pattern of gross domestic and gross national savings. In other words national savings in Pakistan have increased at rates not necessarily associated with an overall expansion in domestic income or Gross Domestic Product.

There are additional reasons (Ogaki, 1996) why saving may be less responsive to changes in real interest rates in Pakistan than in middle-income countries. Rossi (1988) for example argues that low-income developing countries are characterized by perverse liquidity constraints that imply that consumption growth in such countries is more likely to follow income growth than changes in expected rates of return. Clearly (Haque, 1989) the severity of these constraints varies considerably across countries. More recently it has been shown (Vaidyanatham, 1993) that the incidence of liquidity

constraints among households is inversely related to the degree of economic development, implying that saving in poorer countries should be less responsive to interest rate changes.

For Pakistan the intertemporal elasticity of substitution as been estimated (Ogaki, 1996) as having a lower bound of 0.342, a point estimate of 0.494 and an upper bound of 0.647. This compares with rates of 0.133, 0.192 and 0.251 for the poorest countries (of which Pakistan was classified) and 0.398, 0.575, and 0.752 for the lower middle income countries.

In brief, a logical argument can be made that national savings in Pakistan are largely exogenous and not particularly responsive to income or interest rate changes. Specifically that case increases in national savings (from whatever cause) have led to the overall expansion in the economy and not vice versa. If this is true, the factors patterns of savings and investment are also likely to vary from those usually found in developing countries. These causation patterns are examined in detail in the following section.

5. The Issue of Causation

Ultimately any statistical test for causation will be based on a number of arbitrary assumptions. Still, using a number of alternative specifications for the key variables it is possible to make some credible inferences concerning the timing of savings and GDP or of savings and private investment.

The original and most widely used causality test was developed by Granger (1969; 1988). According to this test (again using the example of savings and economic activity), savings (SAV) affect growth of economic activity (EA) if this series can be predicted more accurately by past values of deficits than by past (expenditure) growth

patterns. To be certain that causality runs from loanable funds to EA, past values of loanable funds must also be more accurate than past values of economic activity at predicting increases in savings.

Granger Test

More formally, Granger (1969) defines causality such that X Granger causes (G-C) Y if Y can be predicted more accurately in the sense of mean square error, with the use of past values of X than without using past X. Based upon the definition of Granger causality, a simple bivariate autoregressive (AR) model for savings (SAV) and EA can be specified as follows:

$$(1)\ EA(t) = c + \sum_{i=1}^{p} a(i)SAV(t-i) + \sum_{j=1}^{q} b(j)SAV(t-j) + u(t)$$

$$(2)\ SAV(t) = c + \sum_{i=1}^{r} d(i)\,SAV(t-1) + \sum_{j=1}^{s} e(j)EA(t-j) + v(t)$$

where EA is the growth in economic activity and SAV = the growth in savings; p, q, r and s are lag lengths for each variable in the equation; and u and v are serially uncorrelated white noise residuals. By assuming that error terms (u, v) are "nice" ordinary least squares (OLS) becomes the appropriate estimation method (Hsiao, 1979).

Within the framework of unrestricted and restricted models, a joint F-test is appropriate for causal detection. Where:

$$(3)\ F = \frac{(RSS(x) - RSS(u)/(df(x) - df(u)}{RSS(u)/df(u)}$$

RSS(r) and RSS(u) are the residual sum of squares of restricted and unrestricted models, respectively; and df(r) and df(u) are, respectively, the degrees of freedom in restricted and unrestricted models.

The Granger test detects causal directions in the following manner: first, unidirectional causality from SAV to EA if the F-test rejects the null hypothesis that past values of SAV in equation (1) are insignificantly different from zero and if the F-test cannot reject the null hypothesis that past values of EA in equation (2) are insignificantly different from zero. That is, EA causes SAV but EA does not cause SAV. Unidirectional causality runs from EA to SAV if the reverse is true. Second, bidirectional causality runs between SAV and EA if both F-test statistics reject the null hypotheses in equations (1) and (2). Finally, no causality exists between SAV and EA if we can not reject both null hypotheses at the conventional significance level.

The results of Granger causality tests depend critically on the choice of lag length. If the chosen lag length is less than the true lag length, the omission of relevant lags can cause bias. If the chosen lag is greater than the true lag length, the inclusion of irrelevant lags causes estimates to be inefficient. While it is possible to choose lag lengths based on preliminary partial autocorrelation methods, there is no a priori reason to assume lag lengths equal for all types of deficits.

The Hsaio Procedure

To overcome the difficulties noted above, Hsaio (1981) developed a systematic method for assigning lags. This method combines Granger Causality and Akaike's final prediction error (FPE), the (asymptotic) mean square prediction error, to determine the optimum lag for each variable. In a paper examining the problems encountered in choosing lag lengths, Thornton and Batten (1985) found Hsiao's method to be superior to both arbitrary lag length selection and several other systematic procedures for determining lag length.

The first step in Hsiao's procedure is to perform a series of autoregressive regressions on the dependent variable. In the first regression, the dependent variable has a lag of one. This increases by one in each succeeding regression. Here, we estimate M regressions of the form:

$$(4) \quad G(t) = a + \sum_{i=1}^{m} b(t-1)G(t-1) + e(i)$$

where the values of m range from 1 to M. For each regression, we compute the FPE in the following manner:

$$(5) \quad FPE(m) = \frac{T + m + 1}{T - m - 1} ESS(m)/T$$

Where: T is the sample size, and FPE(m) and ESS(m) are the final prediction error and the sum of squared errors, respectively. The optimal lag length, m*, is the lag length which produces the lowest FPE. Having determined m* additional regressions expand the equation with the lags on the other variable added sequentially in the same manner used to determine m*. Thus we estimate four regressions of the form:

$$(6) \quad G(t) = a + \sum_{i=1}^{m^*} b(t-1)G(t-1) + \sum_{i=1}^{n} c(t-1)D(t-1) + e(i)$$

with n ranging from one to four. Computing the final prediction error for each regression as:

$$FPE(m^*,n) = \frac{T + m^* + n + 1}{T - m^* - n - 1} ESS(m^*,n)/T$$

we choose the optimal lag length for D, n* as the lag length which produces the lowest FPE. Using the final prediction error to determine lag length is equivalent to using a series of F tests with variable levels of significance.

The first term measures the estimation error and the second term measures the modeling error. The FPE criterion has a certain optimality property that "balances the risk due to bias when a lower order is selected and the risk due to increases in the variance when a higher order is selected (Hsiao, 1979)." As noted by Judge et. al (1982) et. al., an intuitive reason for using the FPE criterion is that longer lags increase the first term but decrease the RSS of the second term, and thus the two opposing forces are optimally balanced when their product reaches its minimum.

Depending on the value of the final prediction errors, four cases are possible: (a) Savings cause Economic Activity when the prediction error for economic activity decreases when the savings are included in the activity equation. In addition, when economic activity is added to the savings equation, the final prediction error should increase; (b) Economic Activity causes Savings when the prediction error for savings increases when savings are added to the regression equation for economic activity, and is reduced when economic activity is added to the regression equation for savings; (c) Feedback occurs when the final prediction error decreases when savings are added to the economic activity equation, and the final prediction error decreases when economic activity is added to the savings equation; and (d) No Relationship exists when the final prediction error increases both when savings are added to the economic activity equation and when economic activity is added to the savings equation.

6. Causality Tests Analysis

The data used to carry out the causation tests was derived from figures provided by the World Bank (1997; 1994; 1993; 1992; 1991; 1984) and International Monetary Fund (1996) . A necessary condition for tests of this type is that the variables are

stationary (Hsiao, 1981). All variables were tested (see below) for unit roots using the Augmented Dickey-Fuller Test (Pesaran, 1997). Based on that test the form of each variable was shown to be stationary.

As noted above, there is no theoretical reason to believe that financial aggregates and economic activity have a set lag relationship--that is they impact on one another over a fixed time period. To find the optimal adjustment period of impact, lag structures of up to six years were estimated. The lag structure with the highest level of statistical significance was the one chosen best depict the relationship under consideration (the optimal lag reported in Tables 1). To assess the robustness of our findings two forms of savings were used--the growth in savings and the change is shaving's share of GDP.

Results

The causation analysis produced a number of interesting findings (Table 2):

1. In the case of Gross National and Gross Domestic Savings, (Table 2) two patterns clearly stand out. Contrary to the general case described by Fry, Gross National Saving tends to affect GDP but not versa. That is there is no tendency for increases in the growth of real Gross Domestic Product to subsequently expand Gross National Savings. On the other hand, the growth in Gross Domestic Savings is not statistically linked with that of GDP (while expanded GDP actually lowers the change in Gross Domestic Savings share of GDP).

2. The link between remittances and Gross National Savings is apparent in that both the growth of remittances and increases in the share of remittances in GDP cause a subsequent expansion in GDP.

Table 2

Pakistan: Savings/GDP Causality Patterns

Causal Relationship	Time Period	Direction of Causation	Optimal Lag (Years) Strength
Growth in Real Gross Domestic Product			
(1) Change in Gross National Savings % GDP	1970-95	Savings→GDP(+)	(2) moderate
(2) Growth in Gross National Savings	1970-95	Savings→GDP(+)	(2) moderate
(3) Change in Gross Domestic Savings % GDP	1970-95	GDP→Savings(-)	(1) weak
(4) Growth in Grosss Domestic Savings	1970-1995	No Relationship	
(5) Change in Remittances % GDP	1973-95	Remit→GDP(+)	(2) moderate
(6) Growth in Remittances	1973-95	Remit→GDP(+)	(2) moderate
(7) Change in Financial Savings % GDP	1970-1995	No Relationship	
(8) Growth in Financial Savings	1970-1995	No Relationship	
(9) Growth in Physical Savings	1973-1995	Savings→GDP(+)	(1) weak
(10) Change in Physical Savings % GDP	1973-1995	Feedback(+,+)	(1,3) weak

Note: Summary of results obtained from Granger Causality Tests using a Hsaio Procedure to determine the optimal lag. All variables in stationary form as indicated by the Augmented Dickey-Fuller (ADF) test. In the case of feedback the first term refers to the impact of saving on GDP, while the second refers to the impact of GDP on saving.

3. Interestingly, the analysis could not identify a causal link between financial savings and GDP.

4. Finally physical savings had the most complex pattern with the growth in physical savings producing a subsequent expansion in the growth of GDP. Increases in physical savings share of GDP, however, both affect a subsequent expansion in GDP and in turn expand as GDP growth increases.

The conclusion that Gross national savings affects GDP but not vice versa is borne out by a variance decomposition of the two variables (Table 3). A simulation of Gross National Savings using lagged values of that variable and GDP indicates that even after ten time periods over 95 percent of the variance in savings is accounted for by past values of that variable. On the other hand a similar analysis of GDP indicated that after 10 time periods gross national savings accounted for slightly over 30 percent of its variance. On the other hand after ten time periods GDP explained over twenty two percent of the variance in Gross Domestic Savings.

7. Long-Run Equilibrium Patterns

These relationships characterize the short run linkages between savings and income growth in Pakistan. As an additional exercise an examination was made of the long-run relationship between remittances, savings, and investment. Over the past few years, important advances have been made in cointegration techniques to estimate long run relationships (Cuthbertson, 1992). The basic idea of cointegration is that two or more variables may be regarded as defining a long-run relationship if they move closely together in the long run, even though they may drift apart in the short run. This long-run relationship is referred to as a cointegrating vector. Because there is a long run relationship between the variables, a regression containing all the

Table 3
Variance Decomposition Tests:
GDP, Gross National Savings, Gross Domestic Savings

Period	Standard Error	Gross National Savings	GDP
Variance Decomposition of GNSP With GNSP First in GDP/GNSP VAR			
1	19.26903	100.0000	0.000000
2	25.09521	99.80091	0.199085
3	27.29418	99.83017	0.169827
4	28.21776	99.66283	0.337167
5	28.74615	99.24888	0.751122
6	29.16299	98.67073	1.329269
7	29.55868	98.00712	1.992878
8	29.96414	97.30340	2.696601
9	30.39046	96.58056	3.419444
10	30.84166	95.84724	4.152762

Period	Standard Error	GDP	Gross National Savings
Variance Decomposition of GDPNP with GDP first in GNSP/GDP VAR:			
1	10.44553	100.0000	0.000000
2	15.44213	95.36722	4.632777
3	20.29717	88.12334	11.87666
4	24.97596	82.06894	17.93106
5	29.41416	77.78835	22.21165
6	33.62180	74.86138	25.13862
7	37.64672	72.83095	27.16905
8	41.54147	71.37744	28.62256
9	45.35103	70.29958	29.70042
10	49.11085	69.47349	30.52651

Period	Standard Error	Gross Domestic Savings	GDP
Variance Decomposition of GDSP and GNP with GDSP first in VAR			
1	8.202917	100.0000	0.000000
2	9.720585	85.63001	14.36999
3	9.993133	86.39232	13.60768
4	10.47523	87.60956	12.39044
5	10.61768	87.93853	12.06147
6	10.72193	87.28759	12.71241
7	10.83539	86.00013	13.99987
8	10.96456	83.99911	16.00089
9	11.17911	80.89731	19.10269
10	11.47241	77.22294	22.77706

variables of a cointegrating vector will have a stationary error term, even if none of the variables taken alone is stationary.

It can be shown (Stock, 1987) that in the case of cointegrated non-stationary series, ordinary least squares (OLS) estimates of the cointegrating vector are not only consistent but they converge on their true parameter values much faster than in the stationary case. This proposition does not require the assumption that the regressors be uncorrelated with the error term. In fact, the estimates will remain consistent if any of the variables in the cointegrating vector is used as the dependent variable.

More generally, most of the classical assumptions underlying the general linear model are not required in order for OLS or maximum likelihood estimates of the cointegrating vector to have desirable properties. This is particularly important because errors in variables and simultaneity—both of which would normally be cause for concern in the data set used here—will not affect the desirable properties of the estimates. Moreover, because the cointegration approach focuses on long-run relationships, problems associated with variations in infrastructure utilization and with autocorrelation do not arise.

As noted above, a popular approach to cointegration has been to use unit-root tests such as the Dickey-Fuller (DF) or the augmented Dickey-Fuller (ADF) test (Dickey, 1981) to determine the degree of integration of the relevant variables. Since we are primarily interested in finding longer run relationships between macro variables, the DF and ADF tests are simply undertaken to assure that the cointegration analysis in undertaken on sets of variables that individually are not stationary. More precisely the ADF test consists of running a regression of the first difference of the series against

the series lagged once, lagged difference terms and optionally, a constant and a time trend. With two lagged difference terms, the regression is:

(7) $\Delta y_t = ß_1 y_{t-1} + ß_2 \Delta yt_{-1} + ß_3 \Delta y_{t-2} + ß_4 + ß_5 t$

Several decisions are involved in running the ADF test regression. One is whether to include a constant term in the regression. Another is whether to include a linear time trend. The actual test for a unit root is a test on the coefficient of y_{t-1} in the regression. If the coefficient is significantly different from zero then the hypothesis that y contains a unit root is rejected and the hypothesis that y is stationary is not rejected. In this regard a large negative t-statistic rejects the hypothesis of a unit root and suggests that the series is stationary. Under the null hypothesis of a unit root, the reported t-statistic does not have the standard t distribution and one must consult special tables for critical values.

The results for both the case with and that without a time trend for the DF and ADF tests suggest that the levels of each variable are non-stationary and thus suitable for cointegration analysis.

As noted, a group of non-stationary time series is cointegrated if there is a linear combination of them that is stationary; that is the combination does not have a stochastic trend. The linear combination is called the cointegrating equation and its normal interpretation is a long run equilibrium relationship.

In testing for cointegration between savings various macroeconomic variables we used the procedures of Johansen and Juselius (1990) and began with the vector autoregression (VAR):

(8) $X_t = \prod_1 X_{t-1} + \prod_2 X_{t-2} + \prod_k X_{t-k} + \mu + \varepsilon_t \ (t=1, \ldots, T)$

Where X_t is a p x 1 vector, ε_1 .....ε_T are drawn from a p-dimensional i.i.d. normal distribution with covariance Λ, and X_{-k+1},....X_0 are fixed. Equation (8) can be reparmeterized as

(9) $$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta Xt_{-2} + ... \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \mu + \varepsilon_t$$

where

$$\Gamma_i = -(I + \Pi_1 + ...\Pi_i) \quad (i = 1, ...k-1),$$

And

(10) $$\Pi = -(I - \Pi_1 ....- \Pi_k).$$

The Johansen and Juselius procedure investigates whether the coefficient matrix Π contains information about long-run relationships among the variables of the system. If $0 < \text{rank}(\Pi) = r < p$, then there are matrices α and β of dimension p x r such that $\Pi = \alpha\beta'$ and there are r cointegrating relations among the elements of X_t. β is interpreted as a matrix of cointegrating vectors and provides the property that the elements in $\beta' X_t$ are stationary even though X_t is non-stationary. α is a matrix of error correction parameters.

Operationally, this test involves using the Schwartz Bayesian criterian and Alkaline information criterion to test for the optimal vector autoregression order (Pesaran, 1997). Once that is accomplished two tests known as the λ-max and trace tests to determine the number of cointegrating vectors. When the two tests produced conflicting results, the λ-max test was taken as definitive.

Here the general hypothesis is that the flow of remittances to gross national savings must ultimately flow into productive investment. Furthermore this type of investment must be associated with gross national savings, but not gross domestic savings.

Cointegration Results

The long run equilibrium between Gross National Savings, Gross Domestic Savings and remittances are as anticipated (Table 4):

- No long run relationship exists between gross domestic and gross national savings.
- There is long run equilibrium between gross national savings and remittances, but not between remittances and gross domestic savings.
- Financial savings (Table 5) form a long-term equilibrium pattern with Gross national savings, but not with gross domestic savings. Remittances are also cointegrated with gross national savings and financial savings.

Critical differences also in the manner in which the two forms of savings link with investment (Table 6).

- Gross National savings and remittances form a long run relationship with private investment in manufacturing, but not with non-manufacturing.
- In contrast Gross Domestic savings (which again does not form a long run equilibrium with remittances) is cointegrated with private investment in non-manufacturing but not that in manufacturing.

Finally foreign direct investment has been increasing in importance in Pakistan. Cointegration tests suggest (Table 7) that this type of investment has been largely associated with gross national savings, remittances and private investment in manufacturing. There is no apparent (based on the maximal eigenvalue test) long-run relationship with gross domestic savings and private investment.

8. Conclusions

In recent years, the sources of foreign assistance have become scarce due to a growing shortage in world saving and growing domestic demand for budget

Table 4

Johansen Maximum Likelihood Cointegration Tests:
Gross National/Domestic Savings and Remittances

Hypothesis Null	Alternative	Statistic	95% Critical Value	90% CV
Gross National Savings/Gross Domestic Savings				
Order of VAR = 1				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	8.0559	15.8700	13.8100
r< = 1	r = 2	4.1535	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r> = 1	12.2093	20.1800	17.8800
r< = 1	r = 2	4.1535	9.1600	7.5300
Gross National Savings, Remittances				
Order of VAR = 1.				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	17.7525	15.8700	13.8100
r< = 1	r = 2	5.7647	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r> = 1	23.5172	20.1800	17.8800
r< = 1	r = 2	5.7647	9.1600	7.5300
Gross Domestic Savings/Remittances				
Order of VAR = 1.				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	6.7144	15.8700	13.8100
r< = 1	r = 2	5.3585	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r> = 1	12.0729	20.1800	17.8800
r< = 1	r = 2	5.3585	9.1600	7.5300

Notes: Cointegration with restricted intercepts and no trends in the VAR. Lag structure of VAR determined by highest values of the Akaike Information Criterion and Schwarz Bayesian Criterion. When the two criterion differed, those of the Schwartz Bayesian criterion were used to determine the length. In nearly all cases this was one year. Hence, unless otherwise noted the order of the VAR was 1.

Computations were performed using Microfit 4.0 (Pesaran and Pesaran 1997).

Table 5

Johansen Maximum Likelihood Cointegration Tests:
Gross National/Domestic Savings and Financial Savings

Hypothesis Null	Alternative	Statistic	95% Critical Value	90% CV
Gross National Savings/Financial Savings				
Order of VAR = 1				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	15.9047	15.8700	13.8100
r< = 1	r = 2	2.9161	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r> = 1	18.8208	20.1800	17.8800
r< = 1	r = 2	2.9161	9.1600	7.5300
Gross Domestic Savings/Financial Savings				
Order of VAR = 1				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	13.3841	15.8700	13.8100
r< = 1	r = 2	4.1397	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r> = 1	17.5238	20.1800	17.8800
r< = 1	r = 2	4.1397	9.1600	7.5300
Gross National Savings/Financial Savings/Remittances				
Order of VAR = 1				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	23.3828	22.0400	19.8600
r< = 1	r = 2	9.4702	15.8700	13.8100
r< = 2	r = 3	3.2574	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r> = 1	36.1104	34.8700	31.9300
r< = 1	r> = 2	12.7276	20.1800	17.8800
r< = 2	r = 3	3.2574	9.1600	7.5300
Gross Domestic Savings/Financial Savings				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	13.3841	15.8700	13.8100
r< = 1	r = 2	4.1397	9.1600	7.5300

Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r>= 1	17.5238	20.1800	17.8800
r<= 1	r = 2	4.1397	9.1600	7.5300

Notes: See Table 4.

Table 6

Johansen Maximum Likelihood Cointegration Tests:
Gross National/Domestic Savings and Private Investment

Hypothesis				
Null	Alternative	Statistic	95% Critical Value	90% CV
Gross National Savings/Remittances/Private Investment in Manufacturing				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	24.1329	22.0400	19.8600
r<= 1	r = 2	11.0554	15.8700	13.8100
r<= 2	r = 3	3.7502	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r>= 1	38.9385	34.8700	31.9300
r<= 1	r>= 2	14.8056	20.1800	17.8800
r<= 2	r = 3	3.7502	9.1600	7.5300
Gross National Savings/Remittances/Private non-Manufacturing Investment				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	21.4632	22.0400	19.8600
r<= 1	r = 2	14.8543	15.8700	13.8100
r<= 2	r = 3	3.8716	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r>= 1	40.1892	34.8700	31.9300
r<= 1	r>= 2	18.7260	20.1800	17.8800
r<= 2	r = 3	3.8716	9.1600	7.5300
Gross Domestic Savings/Private non-Manufacturing Investment				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	20.8106	15.8700	13.8100
r<= 1	r = 2	4.8960	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r>= 1	25.7066	20.1800	17.8800
r<= 1	r = 2	4.8960	9.1600	7.5300
Gross Domestic Savings/Private Manufacturing Investment				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	11.1525	15.8700	13.8100
r<= 1	r = 2	10.7574	9.1600	7.5300

Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r>= 1	21.9099	20.1800	17.8800
r<= 1	r = 2	10.7574	9.1600	7.5300

Notes: See Table 4.

Table 7

Johansen Maximum Likelihood Cointegration Tests:
Gross National/Domestic Savings, Private Investment and Foreign Resources

Hypothesis				
Null	Alternative	Statistic	95% Critical Value	90% CV
<u>Gross National Savings/Remittances/Foreign Direct Investment/Private Manufacturing Investment</u>				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	29.3912	28.2700	25.8000
r<= 1	r = 2	18.4766	22.0400	19.8600
r<= 2	r = 3	9.3520	15.8700	13.8100
r<= 3	r = 4	3.6024	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r>= 1	60.8221	53.4800	49.9500
r<= 1	r>= 2	31.4309	34.8700	31.9300
r<= 2	r>= 3	12.9543	20.1800	17.8800
r<= 3	r = 4	3.6024	9.1600	7.5300
<u>Gross National Savings/Remittances/Foreign Direct Investment/Private Investment in non-Manufacturing</u>				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	25.6545	28.2700	25.8000
r<= 1	r = 2	19.9624	22.0400	19.8600
r<= 2	r = 3	16.5277	15.8700	13.8100
r<= 3	r = 4	3.7022	9.1600	7.5300
Cointegration LR Test Based on Trace of the Stochastic Matrix				
r = 0	r>= 1	65.8468	53.4800	49.9500
r<= 1	r>= 2	40.1923	34.8700	31.9300
r<= 2	r>= 3	20.2299	20.1800	17.8800
r<= 3	r = 4	3.7022	9.1600	7.5300
<u>Gross Domestic Savings/Foreign Direct Investment/Private Investment in non-Manufacturing</u>				
Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix				
r = 0	r = 1	21.3425	22.0400	19.8600
r<= 1	r = 2	18.9165	15.8700	13.8100
r<= 2	r = 3	4.8607	9.1600	7.5300

Cointegration LR Test Based on Trace of the Stochastic Matrix

r = 0	r>= 1	45.1197	34.8700	31.9300
r<= 1	r>= 2	23.7772	20.1800	17.8800
r<= 2	r = 3	4.8607	9.1600	7.5300

Notes: See Table 4.

appropriations in the western countries. If economic growth in Pakistan is to be sustained and self-generating, investment in physical and human development must be increased and made more efficient. To meet this challenge, most of the capital will have to come from domestic sources. In this regard, the results of this study are not encouraging.

The patterns found in between savings and economic activity appear to deviate considerably with those usually assumed to exist in developing countries. In particular Gross National Savings appears to be largely determined by exogenous factors--it expands prior to the overall increase in GDP. Since a large component of Gross National Savings consists of worker remittances one can assume that many of the Pakistani expatriates accept foreign employment for the purpose of eventually investing. Interestingly, this investment appears to be largely concentrated in manufacturing (as opposed to non-manufacturing activities). The long run equilibrium between remittances and foreign direct investment suggest that it may not be all that easy (given the decline in remittances) to rely on this source of resources to pick up the slack. The empirical studies cited above also suggest limited increases in savings stemming from financial liberalization.

The main implication of these results is that the country will have a difficult time sustaining investment in manufacturing. With the decline in worker remittances, Gross National Savings rates will gradually come into line with Gross Domestic Savings. At that time the overall pattern of saving and economic activity will revert to the more

normal one of Gross Domestic product leading the expansion in savings. If past patterns hold, and unless the government finds ways of increasing savings, much of this growth lead savings may be more inclined to flow into non-manufacturing as opposed to manufacturing activities.

Looking at the problem a bit differently and focusing on remittances and concessional lending, Haque, Husain and Montiel (1994) note that because of potential Dutch Disease problems associated with external capital inflows, the view one takes about the role of external inflows in Pakistan's recent economic history depends on the uses to which one assumes that they were put. In other words it depends on how policy would have been different in the absence of such inflows. Specifically they note that the fiscal policy actually observed was in part the result of the availability of external resources. If so, to the extent that these resource flows led to increased government consumption of non-tradables, Pakistan's macroeconomic indicators might actually have deteriorated as a result of external inflows. That is country could have done better, at east measured by such indicators, by foregoing its access to such resources and instead maintaining lower fiscal deficits, implemented though reduced government consumption and non-tradables.

On the other hand, if instead, the access to external resources permitted the country to sustain greater levels of government investment, or to maintain lower level of indirect taxation than would otherwise have been the case, then these resources may indeed have made substantial contributions to Pakistan's macroeconomic performance.

While access to external resources obviously permitted Pakistan to run a larger current account deficit than it may otherwise have, their results suggest that growth

in particular may have averaged 0.50-0.75 a percentage point lower per year had only half the observed inflows materialized.

The results in the Haque, Husain and Montiel study while approaching the problem from a different perspective are consistent with the findings presented here. In particular, levels of private investment in manufacturing most likely been considerably lower without worker remittances and associated direct private investment. Again, this conclusion raises the question of the sustainability of Pakistani economic growth in the wake of declining worker remittances and no other obvious ways of increasing resources allocated to productive investment.

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